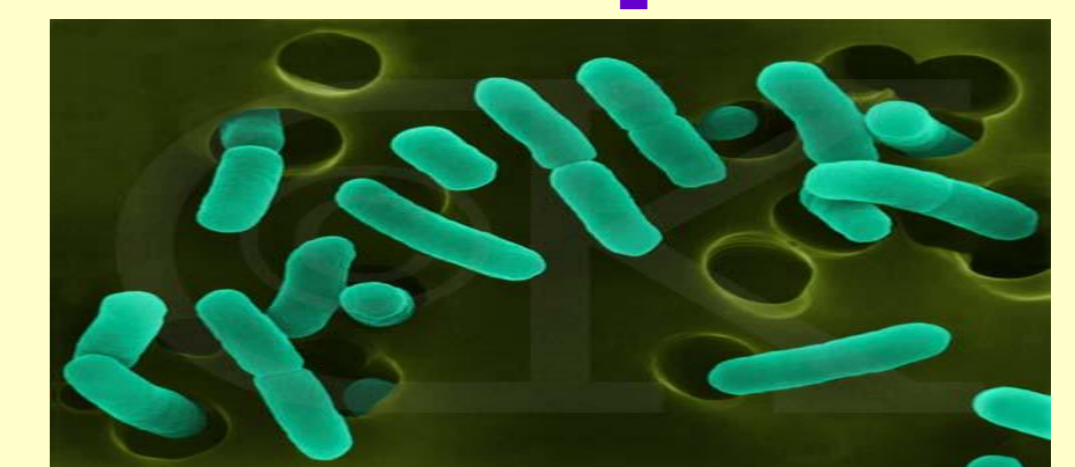


Combining risk assessment and spatial epidemiology to elucidate the source of *E. coli* O157 in Grampian



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Introduction

E. coli O157 is an important pathogen which has emerged as a major public concern in a number of countries across the world. In the UK large outbreaks continue to occur (e.g. Welsh *E. coli* O157 outbreak has >150 cases (1)). The Grampian health board has the highest incidence in the entire world (>10 cases / 100,000 people / year). The reason for this high disease rate is poorly understood. This work presents an analysis of the three main pathways through which human infection occurs: foodborne, waterborne and environmental contact with farm animals (particularly cattle and sheep) and their faeces (2). Two approaches are used (Spatial epidemiology and Quantitative Microbial Risk Assessment – QMRA). The level of agreement of the two approaches is investigated and the importance of this with regards the aetiology of *E. coli* O157 infection is reported.

Materials and methods

The number of *E. coli* O157 cases (1997–2008) were obtained from NHS Grampian at postcode district level. Information about population, cattle and sheep and private water supply (PWS) numbers were collected from external organisations (census 2001, EDINA, local city councils). Data on peoples exposure to various factors (e.g. drinking water from a PWS, contact with animals) were collected by telephone survey.

In the spatial epidemiology approach disease maps were generated and correlated with risk factors using multivariate regression.

In the QMRA approach risk models were generated for each infection pathway and exposure data were used to estimate the number of cases.

Results

Figure 1 shows the map of average incidence of *E. coli* O157 cases at postcode district level for the last 12 years. The average incidence is ~13 cases/100,000/year and is higher in rural areas.

The regression (Figure 2) analysis shows that the disease is most associated with the environment (56%) and food (36%), whereas drinking from PWSs is associated only with 8% of the cases.

Figure 3 shows the predicted number of cases obtained from QMRA's analysis. This shows that 31% of the cases are food associated, 48% come from the environment and 21% are due to drinking from PWSs.

References

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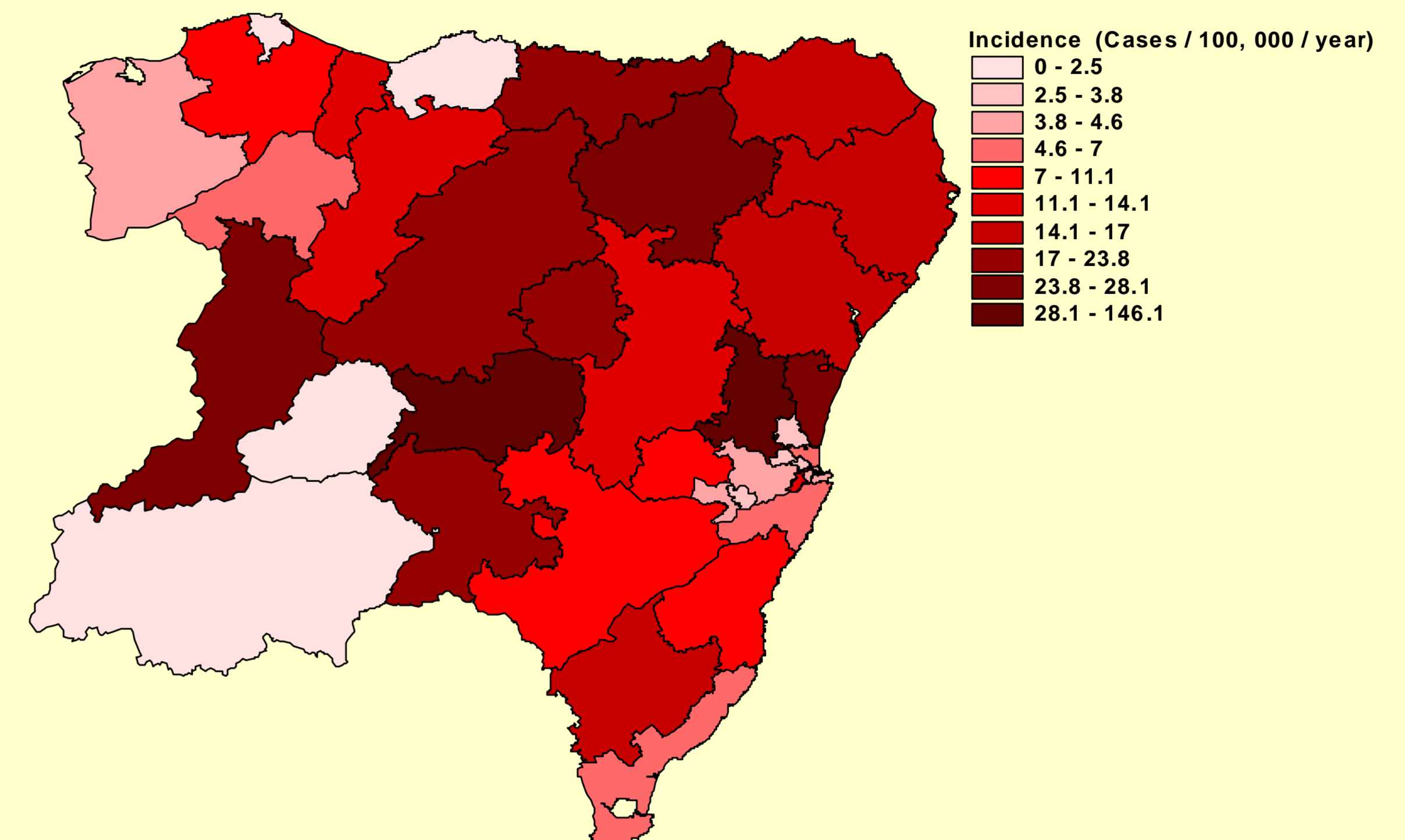


Figure 1. The incidence of *E. coli* O157 (cases / 100,000 / year) in Grampian population (1997– 2008).

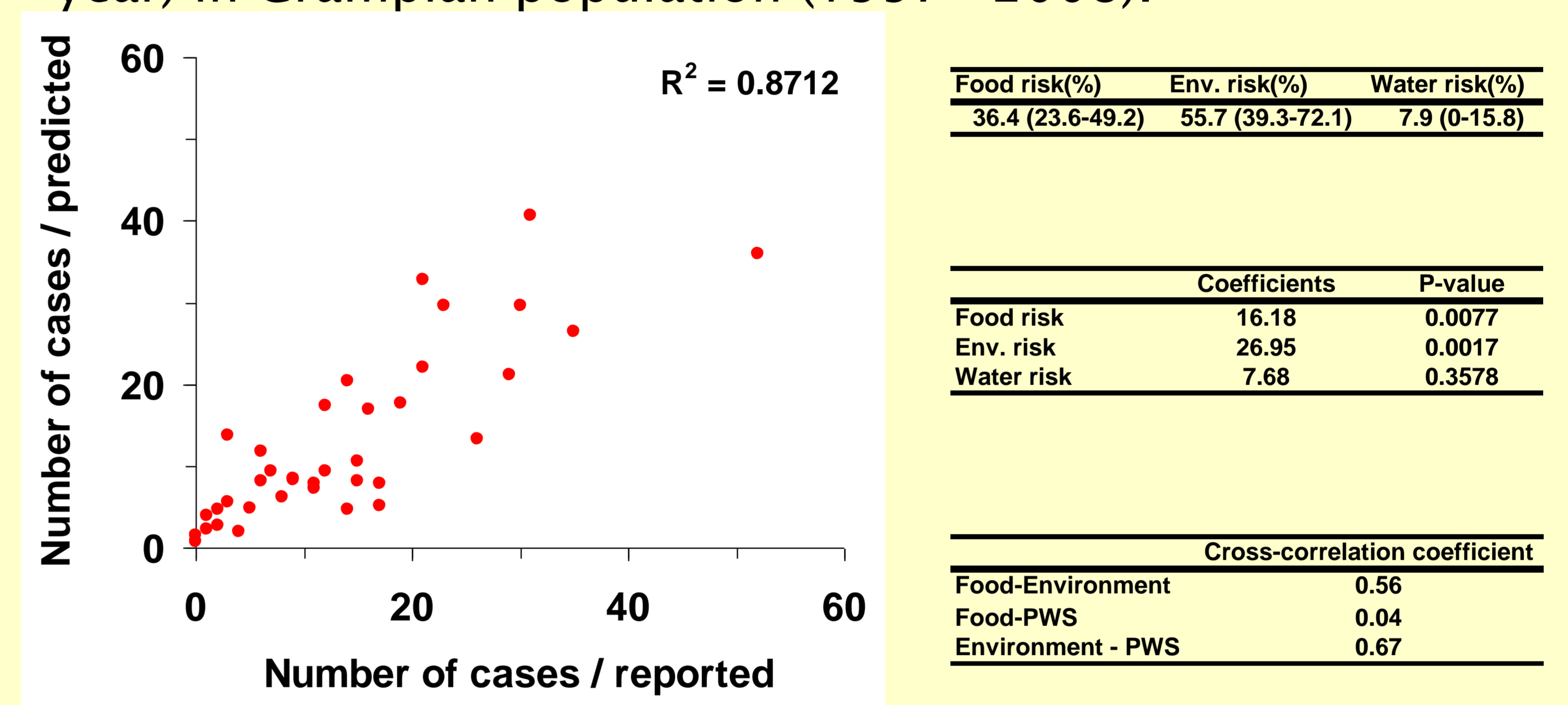


Figure 2. Multivariate regression model. The attribution of human cases to primary pathways of infection.

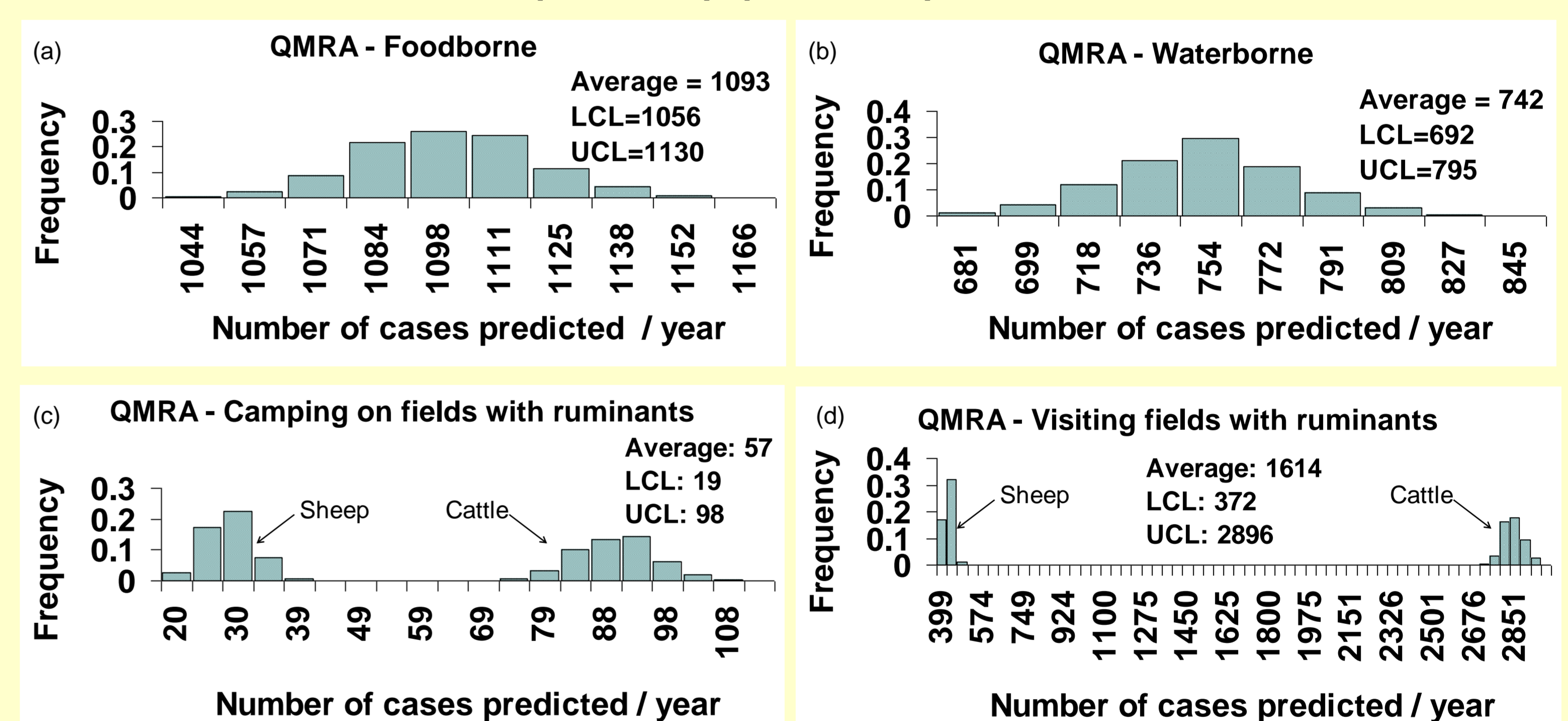


Figure 3. QMRAs by each main pathway of infection: (a) foodborne, (b) waterborne, (c) and (d) environment.

Discussion

Both models show a high association of the disease with the environment. This is plausible given the high exposure of the rural population to cattle and sheep. However, there is a high cross-correlation between waterborne and environmental factors which makes the prediction uncertain in the regression model. The QMRA models overpredict the number of cases by a factor of 50. This might be a consequence of the dose-response model which is based on outbreak data.

Acknowledgements

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